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TABLE OF CONTENTS

ABSTRACT	1
BACKGROUND	2
Figure 1.	5
OBJECTIVES	6
METHODS	6
ACKNOWLEDGEMENTS	9
REFERENCES	10
APPENDICES	15
HISTORY	16
CONTRIBUTIONS OF AUTHORS	16
DECLARATIONS OF INTEREST	16
SOURCES OF SUPPORT	17
NOTES	17

[Intervention Protocol]

Interventions for improving recovery from work

Jorge SINVAL^{1,2,3,4}, Marc van Veldhoven⁵, Tuula Oksanen⁶, Luis Filipe Azevedo⁷, Álvaro N Atallah⁸, Tamara Melnik⁸, João Marôco³

¹Business Research Unit (BRU-IUL), Instituto Universitário de Lisboa (ISCTE-IUL), Lisbon, Portugal. ²Faculty of Philosophy, Sciences and Languages of Ribeirão Preto, University of São Paulo, Ribeirão Preto — SP, Brazil. ³William James Center for Research, ISPA – Instituto Universitário, Lisbon, Portugal. ⁴Faculdade de Medicina, Universidade de Lisboa, Lisbon, Portugal. ⁵Department of Human Resource Studies, Tilburg University, Tilburg, Netherlands. ⁶University of Eastern Finland, Kuopio, Finland. ⁷Center for Health Technology and Services Research (CINTESIS) & Department of Community Medicine, Information and Health Decision Sciences (MEDCIDS), Faculty of Medicine, Porto University, Porto, Portugal. ⁸Brazilian Cochrane Centre, Centro de Estudos de Saúde Baseada em Evidências e Avaliação Tecnológica em Saúde, São Paulo — SP, Brazil

Contact: Jorge SINVAL, jorgesinval@gmail.com.

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ABSTRACT

Objectives

This is a protocol for a Cochrane Review (intervention). The objectives are as follows:

To compare the effectiveness of different individual interventions in recovery from work.

BACKGROUND

Description of the condition

Recovery from work is a fundamental factor for workers' well-being. Recovery can be conceptualized as a process or as an outcome, and these can be considered two different aspects of the same phenomenon (Sonnentag 2009). The first facet of recovery refers to experiences and activities that create change in the strain levels, whereas the worker's physiological and psychological state after the time interval where recovery occurred is a conception of recovery as an outcome (Sonnentag 2017). Recovery from work is the process of replenishing resources after work (Hobfoll 1989). The term recovery can be defined as resuming to a prior state in which one has sufficient physical and mental resources to allow the recommencement of work tasks (Verbeek 2019). It is a process of psychophysiological unwinding and restoration after the expending of individual efforts (Craig 1992; Demerouti 2007; Geurts 2006). It occurs to recuperate from feelings of fatigue, requesting rest to allow resources to be replenished and to recover from effort investments. Through this process, workers may have their energy levels restored and are prepared to resume physical and psychological workloads. When recovery is successful, it can prevent the accumulation of fatigue that leads to serious health problems, and without it, one cannot counterbalance cognitive and physical resources gain (Gorgievski 2008). The need for recovery can be described as the perception of urgency when depletion of energy reserves happens, which leads people to feel the need to have a pause from their demands (Demerouti 2007). The recovery process occurs every time after work and can be a protector of possible negative effects of workload on workers. The lack of recovery occurs due to extended working days (Avgoustaki 2019), which do not necessarily lead to an increase in productivity. This can be seen as a symptom of an early phase of long-term strain that includes psychological distress (Mickel 2012), and that can lead to health problems, such as burnout (Gorgievski 2008; Sinval 2019).

The quality of sleep is an important factor associated with the recovery process (Sonnentag 2003). Like recovery itself, it can be both seen as a recovery process and as a recovery outcome. A proper recovery during non-work time can be accompanied with better sleep quality (Sonnentag 2009; Tucker 2008). Sonnentag 2003 suggests a possible interaction effect of sleep with leisure-time activities on feelings of recovery, alerting to the importance of including measures of sleep in studies that investigate recovery from work. Good sleep can counterbalance the lack of recovery from work, while lack of sleep can decompensate the replenishing effect of recovery after work. In addition, impaired sleep can also be considered an indicator of long-term insufficient recovery from work, which can lead to burnout (Åkerstedt 2009). Sleep is fundamental in the recovery process both in terms of quality and quantity (Fritz 2016), curtailments and disturbances in sleep can have a multiplicity of negative effects (e.g. endocrinological, immunological, metabolism), and can be linked to disease (Åkerstedt 2003).

Since overtime work is associated with the reduced opportunity for physical, mental and emotional recovery (Pencavel 2016), it is expected that occupations that require extended work days are especially demanding, for example, in small businesses where extended opening hours are necessary to keep the business running. Short-term efforts (e.g. exercise/sports and social activities) and long-term efforts (e.g. vacations) can address fatigue

(Bloom 2009), exhaustion and psychological problems such as mood issues (Mickel 2012), but seem to be short-lived (Zijlstra 2006).

Some psychometric instruments associated with the recovery from work process exist, namely, the 'Need for Recovery Scale' (NfR; van Veldhoven 2003) which measures the perceptions of need for recovery after work (van Veldhoven 2008), and was framed from the effort-recovery model. Another instrument is the 'Recovery Experience Questionnaire' (REQ; Sonnentag 2007) drawing on mood regulation and job-stress recovery literature, it assesses how individuals recuperate and unwind from work. Both the NfR and REQ scales presented good psychometric properties (Sonnentag 2007; van Veldhoven 2008). Although it is important to have measurement instruments with good validity evidence (American Educational Research Association 2014), it is not enough and one should be able to decide which intervention to choose based on evidence. So far there are no systematic reviews of interventions for improving recovery from work (to our knowledge) and reviews of that nature would be of special interest to underpin initiatives towards recovery improvement in the workplace. In this Cochrane Review, we will focus on interventions targeted at improving work-related recovery, which should be distinguished from recovery from diseases (i.e. recovery to a state of normal functioning from a state of disease).

Description of the intervention

As suggested by Verbeek 2019, interventions for improving recovery from work can be classified into two types, individual person-directed (i.e. aiming at behavioural change) and directed at changes in the workplace (i.e. aiming at changes in work organization or in work tasks). This review will categorize interventions to further organize, classify and explore their effectiveness. The first type includes an approach to introduce behavioural changes in workers' habits, while the second is concerned with the way the workplace setting is configured towards recovery.

The person-directed interventions can be further grouped as relaxation, promotion of physical activity, recovery training and stress management. Relaxation interventions can be implemented through various techniques (i.e. yoga, listening to music, being in nature, mindfulness, progressive muscle relaxation enhanced with biofeedback or based on intervention mapping with stakeholders). An example of a relaxation intervention is a regular session by an instructor at the workplace (Coffeng 2014). An example of a promotion of physical activity intervention is a one-hour low-intensity running session performed three times a week for six consecutive weeks (de Vries 2015; de Vries 2017). An example of a recovery training intervention is an online training for better sleep in workers (six one-week sessions) that uses cognitive behavioural therapy for insomnia (e.g. stimulus control, sleep hygiene, cognitive interventions and sleep restriction) supplemented with metacognitive therapy, behavioural activation and gratitude research (Thiart 2013; Thiart 2015). An example of a stress management intervention is a web-based intervention with two components (i.e. one of problem-solving and one of emotion regulation) divided into seven sessions with modules for psycho-education (one session), problem-solving (two sessions), emotion regulation (three sessions) and plan for the future (one session); each session could be completed in 45 to 60 minutes and consist of general information, interactive exercises, examples related to

work, audio and video files, quizzes and downloadable mp3 files and worksheets (Ebert 2016a; Heber 2013).

Interventions related to workplace changes can be classified as participatory changes, breaks and workload changes. An example of a participatory change intervention is two 12-month phases: a phase of needs assessment and an implementation phase (Schelvis 2013). In the first phase, workers develop actions to work happily and healthily under the supervision of the heuristic method facilitator using three different steps: 10 one-hour interviews, open-ended questionnaires and group sessions (Schelvis 2017). After the last step, the facilitator informs the management team which interventions can be implemented in the next phase (Schelvis 2013). In the second phase, the changes are implemented by the management teams (Schelvis 2017). An example of a break intervention is a redesign of work–rest schedules (Beynon 2000), whereas an example of a workload changes intervention is a group of four different working schemes between two different jobs (i.e. truck driving and refuse to collect) (Kuijer 2004). The participants work one week as truck drivers only, one week as refuse collectors only, one week rotating between refuse collecting and truck driving (between days) and one week rotating between refuse collecting and truck driving (between the day) (Kuijer 2005).

How the intervention might work

There are several theoretical models that deal with recovery from work and how that process occurs (i.e. resources repletion and depletion) (Demerouti 2009; Verbeek 2019). One of them is the effort-recovery model (Meijman 1998), which states that physiological activation or fatigue are reactions to the efforts invested while working. Recovery occurs, under normal conditions, after the end of the expenditure of the efforts, and the worker is no longer exposed to work demands (Sonnentag 2007). As a consequence, the fatigue and other effects of stressful situations are diminished (Sonnentag 2001). This theoretical framework is based on exercise physiology but can be extended to tasks that demand psychological workload (Sonnentag 2001). This theory states that insufficient recovery can be a serious health risk (Geurts 2014), albeit such risks will not necessarily cause chronic work-related problems, as long the process of recovery occurs (van Hooff 2015). The Nfr psychometric instrument has its theoretical framework based on the effort-recovery theory (van Veldhoven 2003).

The conservation of resources theory suggests that workers have resources that they struggle to obtain, maintain, foster and protect (Hobfoll 1989; Hobfoll 1998; Hobfoll 2002). It is the basis for other theories of organizational stress, such as the job demands-resources model (Hobfoll 2018). The conservation of resources theory states that resource (i.e. things that individuals centrally value) loss, or the threat of such loss, leads to stress (Hobfoll 2001a; Hobfoll 2001b). It is based on four principles (Hobfoll 2018): 1. "primacy of loss principle" – resources loss is more salient than resources gain (Westman 2004); 2. "resource investment principle" – those resources must be invested in order to gain more resources, protect and recover from potential resources losses (Halbesleben 2014); 3. "gain paradox principle" – the gain of resources receives more importance in a scenario of resource loss; and 4. "desperation principle" – when resources levels are at the limit, individuals will adopt a defensive approach. Those defensive efforts will be invested in order to protect the remaining resources (Halbesleben 2014). According to this theory, if recovery is insufficient, people

lose their energy/vitality, which is a valued resource in work and in life (i.e. quality of life). Such loss, or the threat of such loss, can be considered a stressor for workers. Gorgievski 2008 states that the process of resources gain and loss should be seen as a film, not as a snapshot. Such a principle can be applied to work engagement, where gaining cycles of resources can lead to more positive experiences, more risky resources investments and more capabilities to lead in work demands. Resources and work engagement can be reciprocally related (Salanova 2010). Those principles lead to three corollaries: 1. those who have fewer resources are more exposed to vulnerabilities than those with more resources, 2. "resource loss cycles" – those of have fewer resources are more vulnerable and have more tendency to lose resources in the future and 3. "resource gain spirals" – the opposite of the second corollary, that states that those with more resources are less vulnerable and will be capable of gaining more resources in the future. However, the gain spirals tend to be weaker and to develop slowly (Hobfoll 2018). The conservation of resources theory and the effort-recovery model explain complementary processes by which recovery takes place (Sonnentag 2007). The second states that it is essential to recover from work, and avoid tasks that use the same internal resources or functional systems that are used at work, while the first states that acquiring new resources will help to restore the threatened resources (Siltaloppi 2012; Sonnentag 2001).

The allostatic load model (McEwen 1993) states that the constant forcing of physiological activation beyond its maximum capacity can lead to a cumulative effect, may conduct to illness (McEwen 2015). This happens due to the repeated attempts of the body to adjust to the stress challenges. This process is named allostasis, and it consists in the physiological change that the body's multisystems simultaneously undergo to deal with situations of stress (McEwen 1998a). Allostatic overload is seen as the wear and tear of the bodily experiences (McEwen 1993; McEwen 2003), which happen as a consequence of the repeated use of adaptive responses to stress, and of the incapability to turn on or shut off such reactions (Lupien 2015). If there is an absence of recovery, problems may emerge and the adaptive systems can start to fail, conducting to physical and mental deterioration (van Hooff 2011). Contrarily, being able to have a recovery process can be an indicator of good health (Demerouti 2009). Insufficient or incomplete recovery has been linked to allostatic load (von Thiele 2006). The allostatic load model together with the effort-recovery model provide a basis to the essential importance of this psychophysiological unwinding process (i.e. recovery) (Thiart 2013). Since the effort-recovery model does not provide a detailed description of which psychophysiological systems are essential in the recovery process, the allostatic load theory can overcome this limitation of the effort-recovery model (Geurts 2006).

Affect-regulation theory also helps to explain the understanding of recovery from work, since it refers to the mechanism of maintaining or modifying emotions or moods whose operation is dependent on the screening of affective information (Parkinson 1996). Several strategies can be employed to avoid or diminish negative mood, either cognitive or behavioural (Parkinson 1999; Webb 2012). Based on this theory, together with the conservation of resources theory, four core recovery experiences were suggested (Sonnentag 2007): psychological detachment from work, control during off-job time, relaxation and mastery experiences. The psychological detachment from work regards the mental disconnection from work (Sonnentag 2011a). Relaxation concerns a physical and

psychological state of low activity and increased positive affect (Stone 1995). Control during off-job time refers to the level to which individuals have the discretion to choose what to do during their recovery opportunities (i.e. self-determination during leisure time and self-management) (Hahn 2011; Sonnentag 2007). Finally, mastery experiences refer to experiences that the individual has in the off-job time, and that provide challenges and opportunities to learn (Sonnentag 2011a). The four core recovery experiences are measured by four latent variables through the REQ psychometric instrument (Sanz-Vergel 2010; Sonnentag 2007). Based on a meta-analytic study (Newman 2014), two more recovery experiences were proposed, for example, meaning and affiliation. Meaning refers to individuals' needs to feel useful and have a purpose in their lives (Virtanen 2020). Affiliation concerns the need to feel closely and emotionally linked to others (Kujanpää 2021). Additionally, the authors suggested that the recovery experience control during off-job time to be replaced by autonomy, which has a broader scope, since it highlights the importance of one having perceptions of volition in general, and not only regarding the choice of one's leisure schedule (Virtanen 2020). And that the term recovery refers to recovery experience relaxation (Sonnentag 2007), which, altogether create the DRAMMA model: detachment, recovery, autonomy, mastery, meaning and affiliation (Newman 2014). Having the appropriate leisure time, and the subjective experiences during it are fundamental for the recovery from work process (Sonnentag 2017).

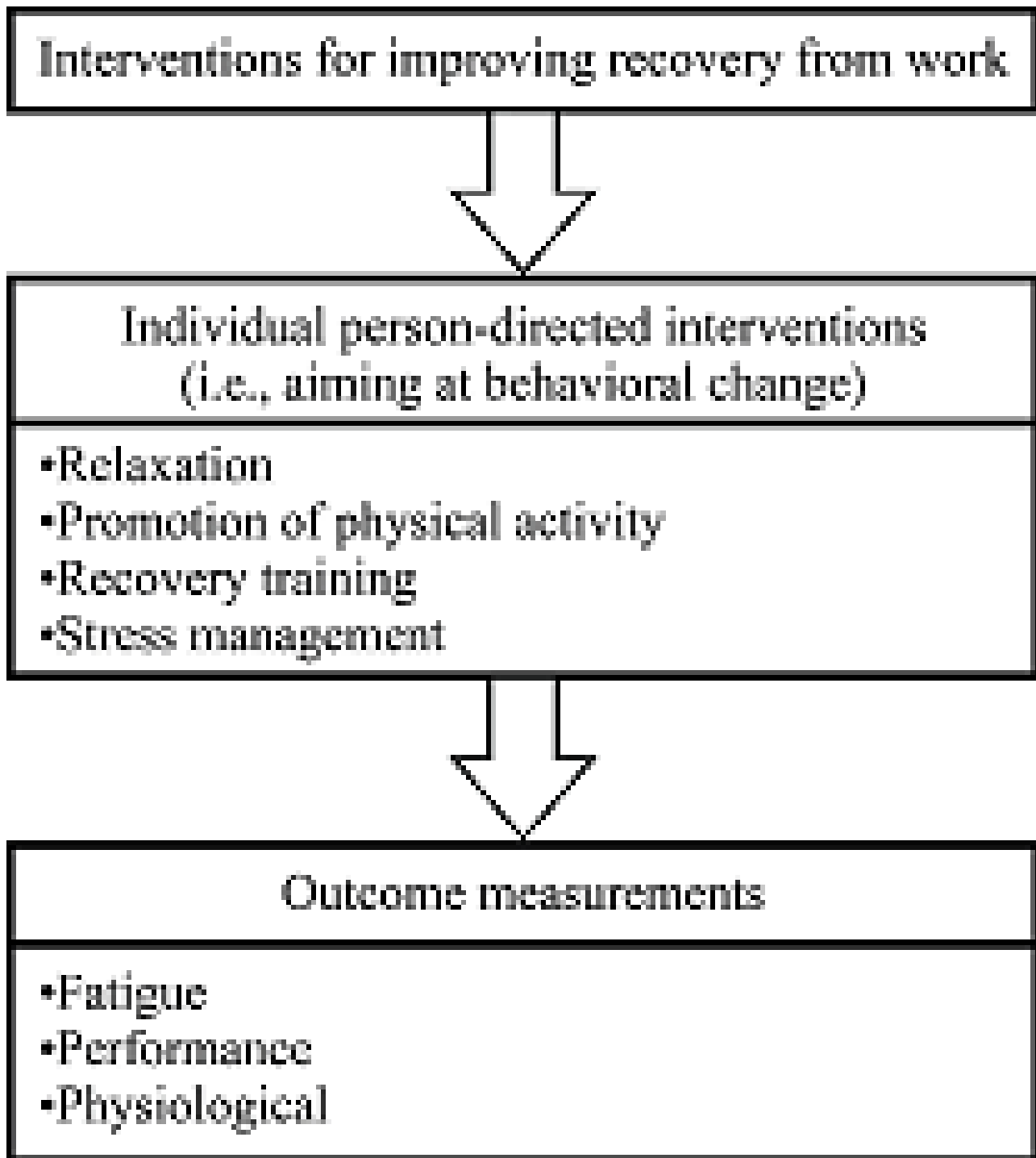
The cognitive activation theory of stress (CATS) states that stress response depends on acquired expectancies of the outcomes of stimuli and available responses (Ursin 2004). Thus, continuous experiences with a particular stimulus make it possible for individuals to regulate and adjust themselves (Meurs 2011). CATS distinguishes four aspects of stress (Eriksen 2017). The stress stimuli or stressor, which consists in the demands or threats to which one is exposed to. The stress experience, which involves one's appraisal of the stressor or situation and the perception of how one will deal with the stressor will lead to experiencing the stressor as pleasant or threatening, it also depends on the fourth aspect, feedback from the stress response. The non-specific, general stress response, which comprises the generic activation (alarm) stimulating wakefulness and arousal in the brain to get ready to solve the stressor or the problem. Finally, the experience of the stress response, it is the feedback obtained with the activation (arousal wakefulness) due to the stressor, and it is fundamental in the way one perceives the stress experience. The short-term activation or phasic arousal created by handling a difficult situation is not a concern for someone who is healthy (Ursin 1978), constant experiences causing arousal and alarm might be a reason for some worry, as the allostatic load theory mentions (McEwen 1998b). However, an important concern arises when there is no solution for the problem or stressor, which with humans is particularly problematic, because such unresolved problems/stressors are accompanied by sustained activation (Eriksen 2005). This concerns the incapacity to downgrade the motivational system and return to 'normal' levels, which might cause serious harm (Eriksen 2005), similar to the failed shutdown of the system suggested by the allostatic load theory (McEwen 1998b). Albeit the CATS differs from the allostatic load model in the extent that it takes into account the importance of the cognitive variable (Eriksen 2005) in the presence of rumination, for example, persistent negative

expectancies and thoughts (Brosschot 2004). This theory helps us to understand the harm caused by lack of recovery from work in the way that the continuous failure to develop recovery from work and the cognitions associated with persistent rumination can lead to serious consequences in health.

Drawing on this latter theory, finally there is the stressor-detachment model (Sonnentag 2011b), which also draws on the previously mentioned allostatic load model. The stressor-detachment model assumes the recovery processes occurs mainly via the detachment from work when being at home. The detachment from work can replenish resources and diminish strain symptoms (Sonnentag 2016). This model states that the stressor-strain process is mediated and moderated by psychological detachment. Lack of the detachment from work is considered to be the core mechanism that can explain the fatigue and other symptoms of an unsuccessful recovery process (Sonnentag 2011b). The mediation process occurs when the job stressors obstruct the detachment from work process, influencing strain and workers' well-being (Sonnentag 2015). The moderation process suggests that psychological detachment affects the impacts of job stressors on poor well-being and strain, lower levels of psychological detachment will lead to increased impact of job stressors on strain and well-being (Sonnentag 2018). The initial model was later extended, adding that the job stressors' impacts on psychological detachment are moderated by personal and job resources (Schulz 2019), higher levels of both can buffer the influence of job stressors on psychological detachment (Sonnentag 2015).

Numerous interventions aim to enhance recovery from work, being individual person-directed or being targeted towards changes at the workplace level (Verbeek 2019). As depicted in Figure 1, there are several options of individual person-directed type (Verbeek 2019). Relaxation techniques are based on the principle that those interventions can increase one's feeling of recovery (Siltaloppi 2012). Physical activity is founded on the principle that such effort will increase stress resilience and improve psychological detachment (de Vries 2017). Recovery training interventions stem from the recovery experiences (Sonnentag 2007) where increasing work engagement or happiness will in turn increase recovery (Feicht 2013; Mastebroek 2015). Stress management interventions are based on problem-based coping and emotion regulation, which are expected to improve recovery (Ebert 2016b; Richardson 2008). Some interventions about the work organization level have been compiled (Verbeek 2019). Participatory changes interventions are based on the principle that more employee resources (e.g. more support for personal and family lives, more control over their work time) can result in increased recovery and civility (Hammer 2016). Interventions of introducing breaks stem from resource-based principles, where more break time can lead to higher reductions of fatigue, better recovery and improved performance (Lim 2016; Mathiassen 1996). Interventions regarding workload changes act through alterations as the task rotation can lead to improved recovery and better musculoskeletal outcomes (Kuijer 2005). For the purpose of the systematic review, we will consider only individual person-directed interventions. These types of intervention are easier to implement, since they are aimed at individual behavioural change, instead of depending on the organization to put it into practice (i.e. changes in the work organization or work tasks).

Figure 1. Logic model of the intervention



Why it is important to do this review

Improved workplace health is a prerequisite to attain the United Nations Sustainable Development Goals, particularly, Goals 1, 3 and 8 (United Nations 2017). The World Health Organization's global plan of action on workers' health emphasized the importance of generating evidence about the health of the working population and using such evidence to produce policies and concrete actions that assure the improvement of workers' health (WHO

2013). Research in workers' health and safety should be a priority (WHO 2016), since the investment in this specific field guarantees a diminution of the direct and indirect costs in terms of health, improves workers' productivity, and raises companies' competitiveness (International Labour Office 2011). In order to accomplish what is expected from them, workers spend energy and effort to achieve work goals (Bennett 2018). Work conditions and demands might deplete workers' cognitive, physical and emotional resources (Meijman 1998), which need to be replaced

after work. The restoration of depleted resources after working hours is essential to protect workers from the possible negative results of workplace stress and to maintain good health (Ebert 2015). Recovery from work is important in the sense that it allows the psychophysiological individual systems to return and stabilize at a baseline level, where no special demands are made on the individual (Geurts 2006). The information gathered through this review can be used to diminish the associated risks with poor recovery from work. This can be particularly important in small businesses where the workload can be difficult to cope with, mainly, when efforts are needed in order to allow company survival.

There are some previous reviews related to recovery from work; one scope review (Verbeek 2019), one literature review (Fehrmann 2014), and three meta-analytic studies (Bennett 2018; Steed 2021; Wendsche 2017). None of these directly addressed the issue of the specific types of interventions employed in improve recovery from work through a systematic revision. Additionally, there are two meta-analyses: one focusing on a specific recovery experience (i.e. detachment from work; Karabinski 2021), and one approaching individual-focused occupational health interventions (Estevez Cores 2021). The scope review revealed that there is uncertainty about the existing evidence, reporting studies that presented opposing results (Verbeek 2019). Since that evidence has not been combined in a systematic review, there is justification to do so (Melnik 2011). Additionally, a meta-analysis – if there are enough suitable studies – will provide evidence about the effects of specific interventions (Verbeek 2012).

OBJECTIVES

To compare the effectiveness of different individual interventions in recovery from work.

METHODS

Criteria for considering studies for this review

Types of studies

We will include eligible randomized controlled trials (RCTs) regardless of whether participants are assigned to groups individually or in clusters (cluster-RCTs). We will include cross-over RCTs, but only data from the first active treatment phase.

Types of participants

We will include studies conducted with currently employed healthy adults of working age (from 18 to 65 years old) and who were exposed to physical or cognitive (or both) workload. We will exclude people with diseases or morbidities that can confound the efficacy of the interventions on the improvement of recovery from work. Specific attention will be given to particular target groups of the interventions as the individuals working in small businesses/self-employed can have a workload difficult to regulate.

Types of interventions

We will include studies that evaluate person-directed interventions for improving workers' process of recovery from work. We will consider different interventions (as described in [How the intervention might work](#)) following Verbeek 2019 classification.

- Individual person-directed.
 - Relaxation.
 - Physical activity.
 - Recovery training.
 - Stress management.

We will include trials that compare the effectiveness of the active intervention with (preferably) active intervention not aimed at increasing recovery (i.e. for an attention effect) or with no intervention or with another active intervention from those that we listed. We will exclude studies that focus only on stress management to avoid overlap with an existing systematic review on the topic (Ruotsalainen 2015). We will exclude studies that focus on occupation-specific recovery standards.

Types of outcome measures

We will produce effects sizes for the different type of interventions, and forest plots and heterogeneity tests to quantify the effectiveness of the different type of interventions.

Primary outcomes

- Recovery from work (e.g. need for recovery, NFr psychometric instrument (van Veldhoven 2003); recovery experiences, REQ psychometric instrument (Sonntag 2007)).
- Performance (e.g. auditory oddball task (Lim 2016)).
- Fatigue (i.e. Borg scale (Borg 1982)).

We chose these primary outcomes because they were suggested by Verbeek 2019 in their scope review (Levac 2010), where they broadly divided the outcomes into three categories (i.e. potential consequences of the lack of recovery, personal or job resources, and workload and other draining of resources).

Secondary outcomes

- Employee satisfaction with the intervention.
- Cost-effectiveness of the intervention.
- Physiological. We will accept any measure based on physiological parameters (i.e. cardiovascular and musculoskeletal).
- Adverse events associated with the intervention.

We will accept any measurement of recovery based on psychometric instruments that showed adequate validity evidence. Potential meta-analysis mediators and moderators might be tested (e.g. recovery experiences, temporal scope of the interventions: at work, after work, unspecific depending on the question to be made) (Shadish 1991). We will consider the following follow-up times for outcome measurement: short-term defined as less than three months after the intervention has been completed, medium-term defined as between three months and less than 12 months, and long-term defined as 12 months or longer.

Reporting one or more of the secondary outcomes listed here in the trials is not an inclusion criterion for the review. Adverse events are not included, as Verbeek 2019 found no reported adverse events.

Search methods for identification of studies

Electronic searches

We will conduct a systematic literature search to identify all published and unpublished trials that can be considered eligible for inclusion in this review. We will adapt the search strategy we developed for MEDLINE for use in the other electronic databases (see [Appendix 1](#)). We will impose no restriction on language of publication. We will arrange for the translation of key sections of potentially eligible non-English language papers or we will arrange people who are proficient in the publications' languages to fully assess them for potential inclusion in the review, as necessary.

We will search the following electronic databases from inception for identifying potential studies:

- Cochrane Central Register of Controlled Trials (CENTRAL) (the Cochrane Library);
- MEDLINE (PubMed) ([Appendix 1](#));
- Embase (embase.com);
- PsycINFO (ProQuest);
- OSH-UPDATE (www.oshupdate.com);
- CINAHL (EBSCO).

We will also conduct a search for unpublished trials in ClinicalTrials.gov (www.ClinicalTrials.gov) and the World Health Organization trials portal (www.who.int/ictrp/en/).

Searching other resources

We will check the reference lists of all included trials and relevant systematic reviews to identify additional trials missed from the original electronic searches (e.g. unpublished or in-press citations). We will contact experts in the field to identify additional unpublished materials.

Data collection and analysis

Selection of studies

We will conduct the selection of eligible studies in two stages using the review management program Covidence ([Covidence](#)). First, two review authors (JS and JM) will independently screen titles and abstracts of all the potentially relevant studies we find with our systematic search to exclude studies that clearly do not fulfil the criteria for inclusion. The same review authors will code them as 'include' (eligible or potentially eligible) or 'exclude'. At this stage, we will exclude all references that clearly do not fulfil our inclusion criteria or that do fulfil our exclusion criteria.

At the second stage, we will retrieve the full-text study reports or publications for all references that we included at the first stage. Two review authors (JS and, MVV) will assess the full-text and identify studies for inclusion, so that all full-text reports are assessed independently by two review authors. We will resolve any disagreements through discussion or, if required, we will consult a third review author (LA). At this stage, we will include all references that do fulfil our inclusion criteria.

We will record reasons for exclusion of the ineligible studies assessed as full texts in a 'Characteristics of excluded studies' table. We will identify and exclude duplicates (at the first stage), and collate multiple reports of the same study so that each study, rather

than each report, is the unit of interest in the review. We will record the selection process in sufficient detail to complete a PRISMA study flow diagram.

Should our systematic searches identify studies conducted by authors of this review, we will avoid conflicts of interest by ensuring all decisions concerning inclusion and exclusion made by review authors who were not involved with the study.

Data extraction and management

Two review authors (JS and JM) will extract the following data on study characteristics and outcomes using [Covidence](#).

- Methods: study design, total duration of study, study location, study setting, withdrawals and date of study.
- Participants: number, mean age or age range, sex/gender, severity of condition, diagnostic criteria if applicable, inclusion criteria and exclusion criteria.
- Interventions: description of intervention, comparison, duration, intensity, content of both intervention and control condition, and cointerventions.
- Outcomes: primary and secondary outcomes specified and collected, and time points reported.
- Notes: funding for trial and notable conflicts of interest of trial authors.

We will check all included trials for a process evaluation, and describe the core elements of the process (e.g. attendance, compliance, dose delivered, dose received, etc.).

Two review authors (JS and JM) will independently extract outcome data from included studies. We will note in the 'Characteristics of included studies' table if outcome data were not reported in a usable way. We will resolve disagreements by consensus or by involving a third review author (LA). One review author (JS) will transfer data into the Review Manager Web ([Review Manager Web 2019](#)). We will double-check that data are entered correctly by comparing the data presented in the systematic review with the study reports. A second review author (JM) will spot-check data for accuracy against the trial report. Should we decide to include studies published in one or more languages in which our author team is not proficient, we will arrange for a native speaker or someone sufficiently qualified in each foreign language to complete a data extraction form for us.

Assessment of risk of bias in included studies

Two review authors (JS and JM) will independently assess risk of bias for each outcome separately using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2019a](#)). We will resolve any disagreements by discussion or by involving another review author (TM). We will assess the risk of bias according to the following domains.

- Random sequence generation.
- Allocation concealment.
- Blinding of participants and personnel.
- Blinding of outcome assessment.
- Incomplete outcome data.
- Selective outcome reporting.
- Other bias.

For cluster-RCTs, we will assess (in addition to the basic RCT risk of bias domains listed above):

- Recruitment bias;
- Baseline differences between clusters.

For cross-over RCTs, we will assess (in addition to the basic RCT risk of bias domains listed above):

- Bias resulting from carry-over effects.

We will grade each potential risk of bias as high, low or unclear, and provide a quote from the study report together with a justification for our judgement in the risk of bias table. We will add the additional domains for other study designs to the risk of bias table. We will summarize the risk of bias judgements across different studies for each of the domains listed. We will consider blinding separately for different key outcomes where necessary. Where information on risk of bias relates to unpublished data or correspondence with a trial author, we will note this in the risk of bias table.

Should our systematic searches identify studies conducted by authors of this review, we will avoid conflicts of interest by ensuring assessment of risk of bias is made by review authors who were not involved with the study.

Overall risk of bias at study level

We will judge a study to have a high risk of bias overall when we judge one or more domains to have a high risk of bias. Conversely, we will judge a study to have a low risk of bias when we judge low risk of bias for all domains.

When considering treatment effects, we will take into account the risk of bias for the studies that contribute to that outcome.

Assessment of bias in conducting the systematic review

We will conduct the review according to this published protocol and report any deviations from it in the 'Differences between protocol and review' section of the systematic review.

Measures of treatment effect

We will enter the outcome data for each study into the data tables in RevMan Web to calculate the treatment effects ([Review Manager Web 2019](#)). We will use risk ratios for dichotomous outcomes, and mean differences (when studies use the same scale) or standardized mean differences (when studies use difference scales) for continuous outcomes, or other types of data (e.g. correlational measures) as reported by the authors of the studies.

If only effect estimates and their 95% confidence intervals or standard errors are reported in studies, we will enter these data into RevMan Web using the generic inverse variance method ([Review Manager Web 2019](#)). We will ensure that higher scores for continuous outcomes have the same meaning for the particular outcome, explain the direction to the reader and report where the directions were reversed if this was necessary. When the results cannot be entered in either way, we will describe them in the 'Characteristics of included studies' table, or in additional tables or narratively.

Unit of analysis issues

Cluster-randomized trials

We will include cluster-RCTs if proper adjustment for the intracluster correlation can be conducted in accordance with the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2019a](#)). If studies report sufficient data to be included in the meta-analysis but do not make an allowance for the design effect, we will calculate the design effect based on a fairly large assumed intracluster correlation of 0.10. We base this assumption of 0.10 being a realistic estimate by analogy on studies about implementation research ([Campbell 2001](#)). We will follow the methods stated in the *Cochrane Handbook for Systematic Reviews of Interventions* for the calculations ([Higgins 2019a](#)).

Cross-over trials

We will include trials employing a cross-over design in the review, but we will only use data from the first active treatment phase. When cross-over trials report continuous outcomes with which the authors have not reported a paired analysis, we will perform a paired analysis based on a reported or imputed correlation between the outcomes of the intervention and the control condition, as advised in the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2019a](#)). For dichotomous outcomes, we will adjust the confidence intervals for the paired analysis according to [Elbourne 2002](#).

Trials with multiple treatment groups

Multiple-arm trials (those with more than two intervention arms) can pose analytical problems in pairwise meta-analyses. For trials with more than two eligible arms, we will manage data in this review as follows.

Multiple experimental intervention groups versus a single control group

If studies compare multiple eligible experimental interventions with a single control group, we will split the control group to enable pairwise comparisons.

Dealing with missing data

We will contact investigators or study sponsors to verify key study characteristics and obtain missing numerical outcome data where possible (e.g. when a study is identified as abstract only).

We also plan to conduct best-/worse-case scenarios for the clinical response outcome, in which we will assume that dropouts in the active treatment group had positive outcomes and those in the control group had negative outcomes (best-case scenario), and that dropouts in the active treatment group had negative outcomes and those in the control group had positive outcomes (worst-case scenario), thus providing boundaries for the observed treatment effect. If a large amount of information is missing, we will give these best-/worst-case scenarios greater emphasis in the presentation of results.

We will analyze missing continuous data on an endpoint basis, including only participants with a final assessment, or by using the last observation carried forward (LOCF) to the final assessment, if trial authors report LOCF data. If numerical outcome data are missing, such as standard deviations or correlation coefficients, and they cannot be obtained from the authors, we will calculate

them from other available statistics such as P values according to the methods described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2019a).

Assessment of heterogeneity

We will assess the clinical homogeneity of the results of included studies based on similarity of population, intervention, outcome and follow-up.

- We will consider populations as similar when they are similar regarding their type and baseline level of workload: cognitive, physical, or both.
- We will consider interventions as similar when they fit inside the same type of intervention (as stated in [Types of interventions](#), where four different intervention types were presented).
- For each of the referred psychometric instruments (e.g. NfR, REQ) original versions, we will consider their correspondent adaptations as similar measures (i.e. different countries, cultures, etc.).
- We will regard follow-up times of short, medium and long term as different (as defined in [Secondary outcomes](#)).

We will use the I^2 statistic to measure heterogeneity among the trials in each analysis. If we identify substantial heterogeneity, we will report it and explore possible causes by prespecified subgroup analysis. We will consider heterogeneity as substantial if I^2 is above 50%.

Assessment of reporting biases

If we are able to pool more than five trials in any single meta-analysis, we will create and examine a funnel plot to explore possible small-study biases.

Data synthesis

We will pool data from studies we judge to be clinically homogeneous, as defined in [Assessment of heterogeneity](#), using Review Manager Web ([Review Manager Web 2019](#)). If more than one study provides usable data in any single comparison, we will perform meta-analyses. We will use a random-effects model because we believe that the type of intervention and study designs included will always lead to heterogeneity. When I^2 is higher than 75%, we will not pool results of studies in meta-analyses.

Where multiple trial arms are reported in a single trial, we will include only the relevant arms. If two comparisons (e.g. intervention one versus no intervention and intervention two versus no intervention) are combined in the same meta-analysis, we will halve the control group to avoid double-counting. We will list all intervention arms, even if they are irrelevant to the review, in the 'Characteristics of included studies' table.

Subgroup analysis and investigation of heterogeneity

We plan to conduct the following two subgroup analyses:

- the use of different measures to assess recovery (i.e. recovery, need for recovery and fatigue); the existence of different baseline workloads (i.e. if higher levels of baseline workload correspond to higher effectiveness of the interventions).

We will use the χ^2 test to test for subgroup interactions in Review Manager Web ([Review Manager Web 2019](#)).

Sensitivity analysis

We will perform sensitivity analyses defined a priori to assess the robustness of our conclusions. This will involve:

- studies with low risk of bias versus studies with high risk of bias.

We will also perform sensitivity analyses to check how our assumptions influence the conclusions of the review.

Reaching conclusions

We will base our conclusions only on findings from the quantitative or narrative synthesis of included studies for this review. We will avoid making recommendations for practice based on more than just the evidence, such as values and available resources. Our implications for research will suggest priorities for future research and outline what the remaining uncertainties are in the area.

Summary of findings and assessment of the certainty of the evidence

We will create summary of findings tables only for the main comparisons that are of best interest to decision makers ([Schünemann 2019a](#)). We will report all outcomes for these comparisons. We will use the five GRADE considerations (study limitations, consistency of effect, imprecision, indirectness and publication bias) to assess the certainty of a body of evidence as it relates to the studies that contribute data to the meta-analyses for the prespecified outcomes. We will use methods and recommendations described in Chapters 8 and 15 of the *Cochrane Handbook for Systematic Reviews of Interventions* using GRADEpro GDT software ([GRADEpro GDT](#); [Higgins 2019b](#); [Schünemann 2019b](#)). We will justify all decisions to downgrade or upgrade the certainty of the evidence using footnotes.

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APPENDICES

Appendix 1. MEDLINE search strategy

#1

work[tw] OR works*[tw] OR work*[tw] OR worka*[tw] OR worke*[tw] OR workg*[tw] OR worki*[tw] OR workl*[tw] OR workp*[tw] OR occupation*[tw]

#2

(Recover*[tw] OR recuperate*[tw] OR unwind*[tw]) AND (“from work” [tw] OR “after work” [tw] OR “need for” [tw] OR “need to”[tw] OR “from fatigue” [tw] OR “from job-stress”[tw] OR physiological[tw])

Interventions for improving recovery from work (Protocol)

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#3

Feeling* AND (“being recovered” OR “being refreshed” OR energized)

#4

“conservation of resources”[tw] OR “depletion of resources”[tw] OR “personal resources”[tw] OR “resource recovery”[tw] OR “replenish resources”[tw] OR “internal resources”

#5

“stress-recovery balance”[tw] OR “effort recovery model”[tw] OR “Conservation of resources theory”[tw] OR “effort expenditure”[tw]

#6

“Fatigue countermeasures”[tw] OR “Disengage from work”[tw] OR “Psychological detachment”[tw] OR “Mental detachment”[tw] OR “Restoration of depleted resources”[tw] OR “Recovery training”[tw] OR “Healthy restorative behaviours” [tw] OR “Recreational activities” [tw] OR “Boundary tactics” [tw] OR “Recovery modalities” [tw] OR “Recovery experience questionnaire” [tw] OR “Off-job activities” [tw] OR “Mastery and control”[tw] OR “Experience of control” [tw] OR “Mood repair” [tw] OR “Diversionary strategies” [tw] OR “Work engagement strategies” [tw] OR “Mastery oriented strategies” [tw] OR “Relaxation oriented strategies”[tw]

#7

(randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab] NOT (animals [mh] NOT humans [mh]))

#8

#1 AND (#2 OR #3 OR #4 OR #5 OR #6) AND #7

HISTORY

Date	Event	Description
8 August 2018	Amended	Edits in the theoretical framework.

CONTRIBUTIONS OF AUTHORS

Conceiving the protocol: JS, MVV, TO, LFA, TM, ÁNA, JM.

Designing the protocol: JS, MVV, TM.

Co-ordinating the protocol: JS.

Designing search strategies: JS.

Writing the protocol: JS.

Providing general advice on the protocol: JS, TM, LFA, MVV.

DECLARATIONS OF INTEREST

JS: none.

MVV is one of the original authors of the NfR psychometric instrument ([van Veldhoven 2003](#)).

TO: none.

LFA: none.

ANA: none.

TM: none.

JM: none.

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NOTES

Parts of the methods section and [Appendix 1](#) of this protocol are based on a standard template established by the Cochrane Work Review Group.